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## **Open and laparoscopic living donor nephrectomy in Switzerland: a retrospective assessment of clinical outcomes and the motivation to donate**

Dahm, Felix ; Weber, Markus ; Müller, Benjamin ; Pradel, Françoise G ; Laube, Guido F ; Neuhaus, Thomas J ; Cao, Claude ; Wüthrich, Rudolf P ; Thiel, Gilbert T ; Clavien, Pierre-Alain

**Abstract:** Background. Laparoscopic living kidney nephrectomy is thought to be associated with reduced morbidity, when compared to open nephrectomy. The purpose of this study was to explore the impact of these techniques on donors' clinical outcomes, satisfaction and motivation to donate. Methods. Clinical outcomes were retrospectively compared in 152 open (n = 71) or laparoscopic (n = 81) donor procedures. Donor satisfaction and motivation were assessed with a self-administered questionnaire. Results. The complication rate was the same with both procedures and the majority of complications were mild. Laparoscopy was significantly less painful and resulted in an insignificantly faster return to active life. More than 80% of the donors volunteered to donate without pressure. Worries about future health status, pain or scars were not important in the decision to donate. Similarly, only 15% considered the surgical procedure as instrumental for their decision. Few donors currently worried about their health with one kidney and more than 95% of the donors in both groups stated that they would give their kidney again. Conclusions. Living donor nephrectomy is safe, regardless of the procedure used. Although the laparoscopic nephrectomy offers clear short-term benefits over the open nephrectomy, donors' satisfaction was excellent with both surgical approaches. Moreover, the type of procedure did not seem to influence their decision to donate

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*Original Article*

## Open and laparoscopic living donor nephrectomy in Switzerland: a retrospective assessment of clinical outcomes and the motivation to donate

Felix Dahm<sup>1</sup>, Markus Weber<sup>1</sup>, Benjamin Müller<sup>1</sup>, Françoise G. Pradel<sup>2</sup>, Guido F. Laube<sup>3</sup>, Thomas J. Neuhaus<sup>3</sup>, Claude Cao<sup>4</sup>, Rudolf P. Wüthrich<sup>4</sup>, Gilbert T. Thiel<sup>5</sup> and Pierre-Alain Clavien<sup>1</sup>

<sup>1</sup>Department of Visceral and Transplantation Surgery, University Hospital Zurich, Rämistr. 100, CH-8091 Zurich, Switzerland, <sup>2</sup>Department of Pharmaceutical Health Services Research, School of Pharmacy, University of Maryland, 515 W Lombard Street, Baltimore, MD 21201-1563, USA, <sup>3</sup>Division of Nephrology, University Children's Hospital Zurich, Steinwiesstr. 75, CH-8032 Zurich, <sup>4</sup>Department of Nephrology, University Hospital Zurich, Rämistr. 100, CH-8091 Zurich and <sup>5</sup>Swiss Organ Living-Donor Health Registry, Division of Nephrology, University Hospital Basel, Petersgraben 4, CH-4056 Basel, Switzerland

### Abstract

**Background.** Laparoscopic living kidney nephrectomy is thought to be associated with reduced morbidity, when compared to open nephrectomy. The purpose of this study was to explore the impact of these techniques on donors' clinical outcomes, satisfaction and motivation to donate.

**Methods.** Clinical outcomes were retrospectively compared in 152 open ( $n=71$ ) or laparoscopic ( $n=81$ ) donor procedures. Donor satisfaction and motivation were assessed with a self-administered questionnaire.

**Results.** The complication rate was the same with both procedures and the majority of complications were mild. Laparoscopy was significantly less painful and resulted in an insignificantly faster return to active life. More than 80% of the donors volunteered to donate without pressure. Worries about future health status, pain or scars were not important in the decision to donate. Similarly, only 15% considered the surgical procedure as instrumental for their decision. Few donors currently worried about their health with one kidney and more than 95% of the donors in both groups stated that they would give their kidney again.

**Conclusions.** Living donor nephrectomy is safe, regardless of the procedure used. Although the laparoscopic nephrectomy offers clear short-term benefits over the open nephrectomy, donors' satisfaction was excellent with both surgical approaches. Moreover, the type of procedure did not seem to influence their decision to donate.

**Keywords:** kidney transplantation; laparoscopy; living donors; personal satisfaction; motivation; quality of life

### Introduction

End-stage renal disease is treated with dialysis or kidney transplantation. Compared to dialysis, transplantation not only improves the quality of life and overall survival [1,2], it is also associated with reduced cost [3,4]. In many countries, the success of kidney transplantation is hampered by a lack of donor organs. The response to this problem ranges from political and regulatory initiatives [5] to donor pool expansion—such as the utilization of older donors [6], donors with comorbidities [7] or non-heart beating donors [8].

The most important step to alleviate the donor shortage has been the increased use of kidneys from living donors. These grafts from carefully selected healthy donors offer superior long-term survival [9] and the possibility of pre-emptive transplantation. It is now well established that kidney donation is a safe procedure [10] and that long-term kidney-donation-related morbidity is low [11]. Still, open nephrectomy via a flank incision can be painful, and is in particular associated with long-term sequelae such as muscular relaxation [12], incisional hernia or dissatisfaction with the cosmetic result [13]. Thus, the development of the laparoscopic technique [14], resulting in smaller incisions, less post-operative pain, shorter hospitalization [15,16] and less long-term abdominal wall problems, has been greeted with enthusiasm by many transplant centres. In Switzerland, three out of six centres perform

Correspondence and offprint requests to: Markus Weber, MD, Department of Visceral and Transplantation Surgery, University Hospital Zurich, Rämistr. 100, CH-8091 Zurich, Switzerland. Email: markus.weber@usz.ch

laparoscopic kidney donation. It has been suggested that this new procedure increases live kidney donation [17] because of higher acceptance of the procedure by donors and, to a larger extent, by recipients [18]. Although the direct costs of the laparoscopic nephrectomy might be more expensive than those of the open nephrectomy procedure in the US setting, the overall costs become lower when all factors, such as earlier return to work, are taken into account [19]. Furthermore, overall cost savings of living donor kidney transplantation (compared to haemodialysis) are so large that they dwarf the costs of the donation procedure [4].

Many clinicians agree that the laparoscopic technique is the preferred surgical option for donors [16]. Psychosocial issues before and after open or laparoscopic living kidney donation have been the subject of several recent studies [20–26]. Whether donors prefer the laparoscopic procedure over the open donor nephrectomy has not been yet explored. The purpose of this study was to explore the impact of these techniques on the donors' clinical outcomes, satisfaction and motivation to donate.

## Subjects and methods

The retrospective clinical part of this study included all living kidney donors ( $n=152$ ) who underwent surgery at the University Hospital of Zurich between January 1977 and October 2003, and who had at least 1 year of follow-up, while the questionnaire-based part included only a subset of patients (see subsequently). The decision on which side to harvest was based on renal ultrasound and angiography. Before July 2000, the harvesting of kidneys was performed by the classical open retroperitoneal lumbotomy ( $n=71$ ); subsequently, all cases were done by the transperitoneal hand-assisted laparoscopic technique ( $n=81$ ) when an experienced laparoscopic surgeon joined the team. All donors received standard post-operative analgesia, plus on-demand medication. Demographics and clinical data were obtained from our database. For the purpose of this study, complications were classified with a five-grade therapy-based system, in which higher grades reflect more severe complications [27].

A self-administered questionnaire assessing donor satisfaction with the surgical procedure was mailed to all eligible donors ( $n=123$ ); donors living abroad ( $n=20$ ) and those whose mailing address was not available ( $n=5$ ) were excluded. The survey instrument had been previously developed and administered in the US [18,28]. It was translated into German with minor adaptations and no further validation, and consisted of 66 questions divided into three sections. The first section included questions relating to the respondents' medical history, the surgical procedure, and the respondents' source of information about living donor kidney transplantation. The second section included 39 attitudinal items measured on a 6-point Likert type scale (1 = strongly disagree, 6 = strongly agree). These items addressed the decision-making process, the surgical procedure, social support and donors' concerns. The final section included demographic information such as religious affiliation, education, insurance and income. The complete

questionnaire can be found online as supplementary material.

The survey package included the questionnaire along with a letter explaining the purpose of the study, a statement of confidentiality and instructions on how to proceed with the questionnaire. Eight weeks after the initial mailing, non-respondents were sent the same survey package a second time. Finally, a telephone follow-up was attempted 8 weeks later with non-respondents and another letter was sent to inquire about their willingness to participate. Formal informed consent was not required, as the letter of invitation contained all relevant information of an informed consent and only consenting donors returned the questionnaire. The study had been approved by the Institutional Review Board of the University Hospital Zurich.

The descriptive statistical analysis included the calculation of mean ( $\pm$ SD) for normally distributed continuous variables, and of median (range) for skewed continuous and ordinal variables. A bivariate analysis was conducted, to compare select variables in the open and laparoscopic groups. The means of continuous variables were compared with the Student's *t*-test. Attitudinal variables were compared with the Mann-Whitney test, and proportions with the Pearson's  $\chi^2$  or the Fisher's exact tests as appropriate. Linear regression analysis was also performed. The level of statistical significance was set at 0.05. Data analysis was performed with SPSS 11.5 for Windows (SPSS Inc., Chicago IL, USA).

## Results

### Demographics

A total of 152 live kidney donors were included in the clinical part of the study ( $n=71$  for open nephrectomy and  $n=81$  for hand-assisted laparoscopic nephrectomy). Demographic characteristics are shown in Table 1.

### Clinical outcomes after nephrectomy

The clinical characteristics of the donors are shown in Table 2. The complication rate was the same for both techniques, with the majority of patients experiencing no or mild complications. Examples of grade 1 complications in both groups (defined as any deviation from the normal post-operative course) were

**Table 1.** Demographic characteristics of kidney donors

	Open ( $n=71$ )	Lap ( $n=81$ )	<i>P</i>
Age: mean ( $\pm$ SD)	44.6 ( $\pm$ 11.5)	49.0 ( $\pm$ 11.8)	0.022
Gender: women	51 (72%)	55 (68%)	0.724
First-degree relative:	46 (65%)	45 (56%)	0.320
Relationship:			0.029
Parent	32 (45%)	22 (27%)	
Spouse	22 (31%)	26 (32%)	
Sibling	14 (20%)	23 (28%)	
Friend	0 (0%)	7 (9%)	
Other	3 (4%)	3 (4%)	

**Table 2.** Clinical characteristics of kidney donors

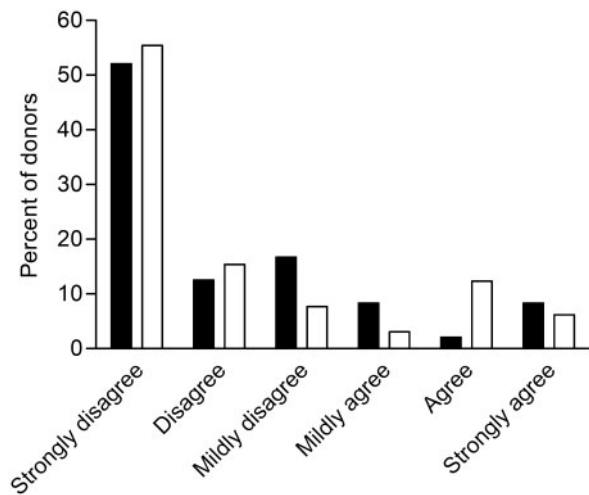
	Open (n = 71)	Lap (n = 81)	P
BMI	24.2 ( $\pm 3.3$ )	24.8 ( $\pm 3.8$ )	0.309
Previous abd. operation	24 (34%)	38 (47%)	0.187
Use of medication			0.403
Antihypertensive	2 (3%)	(6%)	
Other	5 (7%)	8 (10%)	
Left-sided donation	45 (63%)	77 (95%)	<0.001
Single renal artery	50 (70%)	75 (93%)	<0.001
Post-operative complications			0.746
None	54 (76%)	65 (80%)	
Grade 1	10 (14%)	8 (10%)	
Grade 2	4 (6%)	3 (4%)	
Grade 3	3 (4%)	5 (6%)	
Grade 4	0 (0%)	0 (0%)	
Grade 5	0 (0%)	0 (0%)	
Hospital stay in days	8 (4–23)	6 (3–10)	<0.001
Median (range)			

epididymitis, anal fissure, severe nausea, constipation, balanitis, haematoma or wound infections opened at the bedside. The majority of grade 2 complications in both groups (defined as requiring pharmacological interventions) were urinary tract infections. Grade 3 complications after open nephrectomy (per definition requiring a surgical, endoscopic or radiological intervention) were an intra-abdominal abscess, an infected lymphocele and a pneumothorax; while in the laparoscopic cohort, an infected lymphocele, three cases of haematoma, one case of neuralgia and one accidental injury of the colon occurred. No conversions from laparoscopy to an open access were necessary. Hospitalization was significantly shorter after laparoscopic donation.

#### *Satisfaction with the procedure and motivation to donate*

Of the 123 questionnaires mailed, 108 (88%) were returned. The response rates in the open and laparoscopic nephrectomy group were similar, 86 and 89%, respectively. A majority of donors reported that their primary source of information was a nephrologist (data not shown), followed by the media or a family member, with no notable differences between the two groups.

Approximately two-thirds of the donors in both groups had accompanied their recipient to dialysis before the transplantation. A larger proportion of donors in the open cohort found it emotionally difficult to see their recipient on dialysis (open 80%, laparoscopic 58% agreed or strongly agreed,  $P=0.007$ ). Both the groups stated that they 'did not want my recipient to go on dialysis' (open 94%, laparoscopic 85% agreed or strongly agreed,  $P=0.783$ ). Most donors volunteered to donate without pressure from family and/or friends (open 82%, laparoscopic 81% agreed or strongly agreed,  $P=0.247$ ). Before the procedure, a few donors were



**Fig. 1.** Donor agreement (%) with the statement 'The surgical procedure that the doctors used to remove my kidney influenced my decision to donate'. Black bars=open nephrectomy, white bars=laparoscopic nephrectomy ( $P=0.992$ ).

concerned about their future health with only one kidney (open 8%, laparoscopic 3% agreed or strongly agreed,  $P=0.807$ ) or about temporary limitations due to the operation (open 6%, laparoscopic 9% agreed or strongly agreed,  $P=0.246$ ). Religious beliefs played a minor role in the decision to donate (open 2%, laparoscopic 5% agreed or strongly agreed,  $P=0.185$ ). The majority stated that they donated out of love for their recipient (open 98%, laparoscopic 80% agreed or strongly agreed,  $P=0.066$ ). Fifteen percent of the donors in the open group and 18% in the laparoscopic group would not have donated their kidney if they had had to pay for the costs of the procedure ( $P=0.922$ ). A few donors reported worrying about the scar (open 2%, laparoscopic 10% agreed or strongly agreed,  $P=0.703$ ) or pain (open 4%, laparoscopic 14% agreed or strongly agreed,  $P=0.255$ ) before the operation. As shown in Figure 1, the type of procedure was not considered to be of great importance in the decision to donate (open 10%, laparoscopic 22% agreed or strongly agreed,  $P=0.992$ ).

Significantly, more donors in the open nephrectomy cohort reported a great deal of pain immediately after the surgery (47 vs 19% agreed or strongly agreed,  $P=0.013$ ) and after 1 week (23 vs 5% agreed or strongly agreed,  $P=0.001$ ). Compared with laparoscopic donors, open nephrectomy donors were less likely to feel sadness and a sense of loss (0 vs 9% agreed or strongly agreed,  $P=0.072$ ). A few donors felt an immediate sense of reward after donation (23 and 28%, respectively, in the open and laparoscopy cohorts agreed or strongly agreed,  $P=0.984$ ). Laparoscopic donors were more satisfied with medical care (90 vs 77% in the open group agreed or strongly agreed,  $P=0.014$ ). The proportions of open and laparoscopic donors who returned to normal activities within 2 weeks were 19% (open) and 32%



(laparoscopic), while 56% (open) and 66% (laparoscopic) needed less than a month, illustrating a quicker recovery after laparoscopic donation ( $P=0.143$ ).

The final section of the survey dealt with attitudes and emotions 'today', i.e. at the time of answering the questions. The median period between kidney donation and answering the questionnaire was 69 months (37–256) for the open group and 23 months (12–51) for the laparoscopic group. Most donors felt that the public should be more informed about live donor kidney transplantation (open 85%, laparoscopic 80% agreed or strongly agreed,  $P=0.911$ ). Approximately one-third of the respondents reported that they were emotionally closer to their recipient (open 36%, laparoscopic 36% agreed or strongly agreed,  $P=0.686$ ) and the majority thought that the kidney donation was morally correct (open 98%, laparoscopic 91% agreed or strongly agreed,  $P=0.448$ ). A few donors were concerned about their health with only one kidney (open 2%, laparoscopic 3% agreed or strongly agreed,  $P=0.792$ ) or about needing a kidney transplantation in the future (open 0%, laparoscopic 8% agreed or strongly agreed,  $P=0.848$ ). In response to the statement 'I would do it again', there was almost universal agreement in both groups (open 100%, laparoscopic 95%,  $P=0.386$ ). This did not correlate with the time of follow-up by linear regression analysis ( $R=0.001$ ,  $P=0.990$ ).

## Discussion

We retrospectively evaluated the clinical and psychosocial outcomes in two consecutive cohorts of donors, who had their kidney removed either with open ( $n=71$ ) or laparoscopic ( $n=81$ ) nephrectomy. Donors in the laparoscopic cohort were significantly older, but there were no significant differences regarding previous abdominal operations or the use of medications. The relationship between donors and recipients differed between the two cohorts. In the laparoscopic group, there were fewer parental donations, while donations from siblings and friends occurred more frequently. These findings probably reflect an increased experience with the living donation procedure and an expansion of the eligibility criteria for donors, as the law was not changed in this respect.

The laparoscopic approach strongly favoured the left kidney, as previously reported [29]. Additionally, fewer laparoscopic donors had multiple arteries. The post-operative course was similar in both cohorts. Every fifth donor experienced a complication, although these were mostly mild. Complications requiring surgical or radiological interventions occurred in 5% of the cases, and life-threatening complications never occurred. This complication rate is in agreement with other studies [29,30] and underscores the safety of live kidney donation. The length of hospitalization was shorter after laparoscopic donation. However, this result might be overly conservative,

as our policy allows donors to stay as long as their recipients for psychosocial reasons.

Our results on the immediate post-operative period concur with the findings from a randomized trial comparing open and laparoscopic donor nephrectomy [15]; laparoscopic donors reported significantly lower degrees of pain immediately after the operation and after 1 week, as well as an insignificantly faster recovery to normal activity.

A majority of donors expressed emotional difficulty in seeing recipients on dialysis and donated out of love, illustrating a strong emotional bond between donors and their recipients. More than 80% of the donors volunteered without pressure from friends or family. This finding differs from the findings of another study, where donors reported higher degrees of ambivalence in their motivation to give a kidney, especially in donations to siblings [21]. Such effects could not be found in subgroup analyses of our data.

The type of surgical procedure did not seem to have a strong influence on the donor decision-making process. It should be noted that the respondents in both groups were offered only one technique. Therefore, they could not really compare both procedures. Answers in both groups were similar, suggesting a high degree of motivation of live donors as well as marginal impact of the type of surgical procedure on their decision-making process. Our results are similar to the study conducted in the US. Although a higher proportion of donors in the US stated that the type of procedure was important in their decision to donate (39% agreed or strongly agreed), the main finding was that the type of nephrectomy mostly affected the kidney recipients and not the donors themselves [18]. Since laparoscopic nephrectomy might be associated with an increased rate of donation [17], our results and prior research suggest that it is likely to occur through its impact on potential kidney recipients. Our results also reveal that worries about future life with one kidney or post-surgical pain play a rather small role in the donors' decision to give a kidney. The subjective cosmetic advantage of laparoscopy might be overestimated in this specific population of patients, as donors did not worry about the scar and did not consider the type of surgical procedure to have been of much importance in their decision to donate.

Although the participants' answers to questions relating to the period right after donation suggest that they favour the laparoscopic approach, this trend is not maintained in the long term. One-third of the respondents reported a closer emotional relationship with the recipient after donation, similar to the finding of a study conducted in Germany [20]. Very few of our donors were concerned about their health with one kidney, similar to a recent Canadian study [26] and in contrast to an analysis from Germany, where one-third of the donors had temporary fears about their own health [22].

An overwhelming proportion of donors agreed or strongly agreed with the statement 'I would do it again'

regardless of the procedure used or the relationship between the donor and the recipient. Such a small number of donors voiced any regrets about their decision to donate a kidney (none in the open group and three in the laparoscopic group), so no further analyses could be performed in these donors. Donating a kidney to a loved one can be an emotionally satisfying 'gift of life', irrespective of the surgical approach used. There is empirical evidence that only a marginal number of donors regret their decision [20,21,24,26,31]. Several studies have found a better quality of life in kidney donors than in the general population [20,31–33].

A major strength of this study is the exceptionally high response rate to the mail survey. However, several limitations of the current study deserve attention. Comparisons were performed between two consecutive cohorts of live kidney donors. Kidney harvesting was performed by the open procedure before mid 2000 and by the hand-assisted laparoscopic procedure thereafter. Effects resulting from general changes in peri-operative management or donor selection cannot be controlled in this study. The time elapsed between donation and answering the questionnaire was longer for open than for laparoscopic donors (median of 69 vs 21 months), which could influence attitudes or distort answers. However, additional regression analysis showed that the length of time had no influence on donor satisfaction. Although there were no overall differences between the two groups, the few donors who voiced regret or worried about living with only one kidney were all from the laparoscopic group, and thus closer in time to the procedure. Perhaps health worries subside with time, and regret occurs less often for patients who donated their kidney several years ago. However, it cannot be excluded that the change of attitudes over time is different for open and laparoscopic donors and that, with continuing follow-up, responses from laparoscopic donors might change. Furthermore, the results of this survey must be interpreted in the light of the Swiss healthcare system with universal health insurance coverage.

In conclusion, the main finding of our study is that although the laparoscopic approach offers the short-term benefits of less pain, shorter hospitalization and quicker return to activity, the type of surgical procedure is not a very important factor in the donor's decision-making process. Donors are highly motivated and committed to donation, suggesting that an increase in the rate of live kidney donation would rather be expected through a positive influence of the laparoscopic procedure on recipients. After the immediate post-operative period, the advantages of laparoscopy fade, as all live kidney donors experience a high degree of satisfaction. The influence of the laparoscopic technique on long-term donor satisfaction seems less important than anticipated. A laparoscopic nephrectomy should be offered for living kidney donation due to its significant short-term benefits. Still, the open nephrectomy approach seems to be a valid option from a donor's perspective.

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